

Variability in the Analysis of Wipe Samples Taken for Methamphetamine Contamination

By

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March 19, 2008

Introduction:

At the current time, the determination as to whether or not a structure is contaminated with methamphetamine is based upon police reports indicating that a clandestine methamphetamine lab was found at that site or through the use of wipes to detect the presence of methamphetamine. In addition, if a structure is determined to have been a clandestine methamphetamine laboratory, the efficacy and effectiveness of the clean-up is determined primarily through the use of wipes collected and analyzed for methamphetamine.

At the time of this report, most states consider a structure to be contaminated with methamphetamine even if very low amounts of methamphetamine are present. Most states require structures to have less than $0.1 \mu\text{g} - 0.5 \mu\text{g}/100 \text{ cm}^2$ to be considered “remediated”. An example of the requirements from different states are as follows:

<i>State</i>	<i>Specified Value</i>	<i>Unified Value</i>
Alaska	$0.1 \mu\text{g}/100 \text{ cm}^2$	$0.1 \mu\text{g}/100 \text{ cm}^2$
Arizona	$0.1 \mu\text{g}/100 \text{ cm}^2$	$0.1 \mu\text{g}/100 \text{ cm}^2$
Arkansas	$0.5 \mu\text{g}/\text{ft}^2$	$0.05 \mu\text{g}/100 \text{ cm}^2$
Colorado	$0.1 \mu\text{g}/100 \text{ cm}^2$	$0.1 \mu\text{g}/100 \text{ cm}^2$
Minnesota	$<1 \mu\text{g}/\text{ft}^2$	$<0.1 \mu\text{g}/100 \text{ cm}^2$
Oregon	$0.5 \mu\text{g}/\text{ft}^2$	$0.05 \mu\text{g}/100 \text{ cm}^2$
Tennessee	$0.1 \mu\text{g}/100 \text{ cm}^2$	$0.1 \mu\text{g}/100 \text{ cm}^2$
Utah	$0.1 \mu\text{g}/100 \text{ cm}^2$	$0.1 \mu\text{g}/100 \text{ cm}^2$

All of these values are very low and are close to the quantifiable amount of methamphetamine that can be determined by most laboratories using conventional methods. Data Chem Laboratories located in Salt Lake City, Utah, for example, uses a modified National Institute of Occupational Safety and Health Method (NIOSH Method 9111 Draft) for the analysis of methamphetamine using liquid chromatography and mass spectrometry. The reporting limit for the laboratory is currently at $0.1 \mu\text{g}$ of methamphetamine per sample, although they can quantify methamphetamine at levels down to $0.05 \mu\text{g}/\text{sample}$. Some laboratories using gas chromatograph and mass spectrometry can report levels as low as $0.03 \mu\text{g}/\text{sample}$.

Due to the fact that most of the current standards are near the detection limit for methamphetamine, the accuracy, precision, and specificity for the laboratory methods become very important. A false positive result above $0.1 \mu\text{g}/100 \text{ cm}^2$ might result in

thousands of additional dollars being spent on a clean-up effort when there was not detectable methamphetamine present. The purpose of this study was to determine the ability of analytical laboratories to correctly identify methamphetamine on a wipe sample and to correctly report the amount of methamphetamine present. We concentrated primarily on the lower levels since inaccuracy at these levels may result in the failure of a structure to pass clearance inspection.

Previous Studies:

During the National Jewish Medical Center Research involving exposures at clandestine methamphetamine laboratories a number of methamphetamine samples were collected as both blanks and as pre-contamination samples at our “controlled” methamphetamine cooks. The samples obtained were as follows:

Blank Methamphetamine Wipe Sample Results

Site	Date	Type	Non Detect	Level (µg)
CO Spgs	1/10/2003	precook	no	5.4
CO Spgs	1/10/2003	precook	no	0.3
CO Spgs	1/10/2003	precook	no	7
5400 Sheridan	3/13/2003	Blank	yes	
2703 acoma	3/23/2003	Blank	no	5.7
959 lilac	4/2/2003	Blank	yes	
959 lilac	4/2/2003	Blank	yes	
6250 Federal	4/12/2003	Blank	yes	
2305 w92nd	4/16/2003	Blank	yes	
Trinidad Jeep	4/25/2003	Blank	yes	
Trinidad Jeep	4/25/2003	Blank	yes	
Trinidad Jeep	4/25/2003	Blank	yes	
Trinidad Jeep	4/25/2003	Blank	yes	
Trinidad Jeep	4/25/2003	Blank	yes	
Denver	5/17/2003	precook	yes	
Denver	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Denver	5/17/2003	precook	yes	
Denver	5/17/2003	precook	yes	
Denver	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Denver	5/17/2003	precook	yes	
Denver	5/17/2003	precook	yes	

Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Denver	5/17/2003	precook	yes	
Denver	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
Scienturfic Home	5/17/2003	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
New Mexico	1/15/2004	precook	yes	
CO Spgs	4/5/2005	precook	no	14
CO Spgs	4/5/2005	precook	no	23
CO Spgs	4/5/2005	precook	no	13
CO Spgs	4/5/2005	precook	no	5.7
CO Spgs	4/5/2005	precook	no	1.5
Dallas	23-Apr	precook	yes	
Dallas	23-Apr	precook	yes	
Dallas	23-Apr	precook	yes	
Dallas	23-Apr	precook	yes	
Dallas	23-Apr	precook	yes	
Dallas	23-Apr	precook	yes	
Dallas	23-Apr	Blank	yes	
Dallas	23-Apr	Blank	no	0.1

A total of 63 samples were collected as blanks or as pre-cook samples. A total of 53 (84%) of those samples were reported as non-detect by the laboratory. The positive levels found ranged from 0.1 µg/sample to 23 µg/sample. However, 5 of the positive samples were at one location in Colorado Springs where it is likely that the house had been used to cook methamphetamine prior to our sampling at that location. In addition, 3

of the other positive samples were obtained from the hood in the Colorado Springs Police Department where methamphetamine had been previously used. If those 8 samples are eliminated, then only 2 samples of the 55 total samples resulted in a positive result for a total of 53 non-detectable samples (96%). The two positive samples were 0.1 µg/sample and 5.7 µg/sample. Both samples were blanks and may have been a result of a switch of samples or a difficulty in analysis.

The Minnesota State Health Department also submitted a number of blank samples as well as a number of known spikes to six separate laboratories. The results were reported on the Minnesota State Health Department Website in a report dated 03/05 and entitled “Analytical Results of “Round Robin” Blind Study #1 and #2”. The report lists the results of 117 samples of known concentration sent to the individual laboratories. We assumed that the laboratories in study #2 are the same as in study #1 and that they are lettered in the same fashion. The samples taken were as follows:

Minnesota Wipe Sample Round Robin Study

Lab	Spike Conc.	Results	Difference	% Diff.	Abs Diff.	Abs % Diff.
A	0.4	0.58	-0.18	-45.0	0.18	45.0
A	0.4	0.63	-0.23	-57.5	0.23	57.5
B	0.4	0.272	0.13	32.0	0.13	32.0
B	0.4	0.292	0.11	27.0	0.11	27.0
C	0.4	0.66	-0.26	-65.0	0.26	65.0
C	0.4	0.73	-0.33	-82.5	0.33	82.5
D	0.4	0	0.40	100.0	0.40	100.0
D	0.4	0	0.40	100.0	0.40	100.0
E	0.4	0.35	0.05	12.5	0.05	12.5
E	0.4	0.5	-0.10	-25.0	0.10	25.0
F	0.4	0	0.40	100.0	0.40	100.0
F	0.4	0	0.40	100.0	0.40	100.0
A	4	3.436	0.56	14.1	0.56	14.1
A	4	3.38	0.62	15.5	0.62	15.5
A	4	4.8	-0.80	-20.0	0.80	20.0
A	4	4.64	-0.64	-16.0	0.64	16.0
B	4	1.47	2.53	63.3	2.53	63.3
B	4	1.64	2.36	59.0	2.36	59.0
B	4	2.35	1.65	41.3	1.65	41.3
B	4	2.17	1.83	45.8	1.83	45.8
C	4	4.3	-0.30	-7.5	0.30	7.5
C	4	4.6	-0.60	-15.0	0.60	15.0
C	4	6.3	-2.30	-57.5	2.30	57.5
C	4	6.3	-2.30	-57.5	2.30	57.5
D	4	0	4.00	100.0	4.00	100.0
D	4	0	4.00	100.0	4.00	100.0

D	4	0	4.00	100.0	4.00	100.0
D	4	0	4.00	100.0	4.00	100.0
E	4	3.06	0.94	23.5	0.94	23.5
E	4	3.12	0.88	22.0	0.88	22.0
E	4	4.29	-0.29	-7.3	0.29	7.3
E	4	4.51	-0.51	-12.8	0.51	12.8
F	4	0	4.00	100.0	4.00	100.0
F	4	0	4.00	100.0	4.00	100.0
F	4	0	4.00	100.0	4.00	100.0
F	4	0	4.00	100.0	4.00	100.0
A	5	4.48	0.52	10.4	0.52	10.4
A	5	4.55	0.45	9.0	0.45	9.0
B	5	2.9	2.10	42.0	2.10	42.0
B	5	3	2.00	40.0	2.00	40.0
C	5	6.4	-1.40	-28.0	1.40	28.0
C	5	6.4	-1.40	-28.0	1.40	28.0
D	5	0	5.00	100.0	5.00	100.0
D	5	0	5.00	100.0	5.00	100.0
E	5	6	-1.00	-20.0	1.00	20.0
E	5	5.3	-0.30	-6.0	0.30	6.0
E	5	4.7	0.30	6.0	0.30	6.0
F	5	4.1	0.90	18.0	0.90	18.0
F	5	3.7	1.30	26.0	1.30	26.0
F	5	4.1	0.90	18.0	0.90	18.0
F	5	3.7	1.30	26.0	1.30	26.0
A	40	31.44	8.56	21.4	8.56	21.4
A	40	30.48	9.52	23.8	9.52	23.8
B	40	37.6	2.40	6.0	2.40	6.0
B	40	36.3	3.70	9.3	3.70	9.3
C	40	61	-21.00	-52.5	21.00	52.5
C	40	60	-20.00	-50.0	20.00	50.0
D	40	16.8	23.20	58.0	23.20	58.0
D	40	6.4	33.60	84.0	33.60	84.0
E	40	56.55	-16.55	-41.4	16.55	41.4
E	40	51.06	-11.06	-27.7	11.06	27.7
F	40	6.32	33.68	84.2	33.68	84.2
F	40	6.08	33.92	84.8	33.92	84.8
A	50	25.9	24.10	48.2	24.10	48.2
A	50	25.3	24.70	49.4	24.70	49.4
B	50	29	21.00	42.0	21.00	42.0
B	50	26.8	23.20	46.4	23.20	46.4
C	50	69	-19.00	-38.0	19.00	38.0
C	50	70	-20.00	-40.0	20.00	40.0

D		50	0.2	49.80	99.6	49.80	99.6
D		50	0.1	49.90	99.8	49.90	99.8
E		50	58.4	-8.40	-16.8	8.40	16.8
E		50	55.8	-5.80	-11.6	5.80	11.6
E		50	46.8	3.20	6.4	3.20	6.4
E		50	44.6	5.40	10.8	5.40	10.8
F		50	38	12.00	24.0	12.00	24.0
F		50	36	14.00	28.0	14.00	28.0
A		120	57.6	62.40	52.0	62.40	52.0
A		120	63.2	56.80	47.3	56.80	47.3
B		120	44	76.00	63.3	76.00	63.3
B		120	65.6	54.40	45.3	54.40	45.3
C		120	150	-30.00	-25.0	30.00	25.0
C		120	160	-40.00	-33.3	40.00	33.3
D		120	11.2	108.80	90.7	108.80	90.7
D		120	31.2	88.80	74.0	88.80	74.0
E		120	130.11	-10.11	-8.4	10.11	8.4
E		120	122.2	-2.20	-1.8	2.20	1.8
F		120	43.6	76.40	63.7	76.40	63.7
F		120	52.8	67.20	56.0	67.20	56.0
A		150	147	3.00	2.0	3.00	2.0
B		150	106.3	43.70	29.1	43.70	29.1
C		150	270	-120.00	-80.0	120.00	80.0
D		150	0.5	149.50	99.7	149.50	99.7
E		150	186.3	-36.30	-24.2	36.30	24.2
E		150	149.6	0.40	0.3	0.40	0.3
F		150	120	30.00	20.0	30.00	20.0
F		150	120	30.00	20.0	30.00	20.0
A	Blank		0.03	NA	NA	NA	NA
A	Blank	ND		ND	ND	ND	ND
A	Blank	ND		ND	ND	ND	ND
B	Blank	<0.01		NA	NA	NA	NA
B	Blank		0.0267	NA	NA	NA	NA
B	Blank	ND		ND	ND	ND	ND
C	Blank	ND		ND	ND	ND	ND
C	Blank	ND		ND	ND	ND	ND
C	Blank	ND		ND	ND	ND	ND
D	Blank	ND		ND	ND	ND	ND
D	Blank	ND		ND	ND	ND	ND
D	Blank	ND		ND	ND	ND	ND
E	Blank	ND		ND	ND	ND	ND
E	Blank	ND		ND	ND	ND	ND
E	Blank	ND		ND	ND	ND	ND

E	Blank	ND	ND	ND	ND	ND
F	Blank	ND	ND	ND	ND	ND
F	Blank	ND	ND	ND	ND	ND
F	Blank	ND	ND	ND	ND	ND
F	Blank	ND	ND	ND	ND	ND

ND = Non-Detect

NA = Not Applicable

Abs Diff. = Percent absolute difference

The data that they provide indicates that the blank samples were likely to be reported as non-detect. Out of the 20 blank samples reported, only 2 samples were reported as a positive. One was reported by Laboratory A (0.03 µg) and one by Laboratory B (0.03 µg). Both of these levels are very low, although they do represent false positive results.

The results obtained from the spike samples showed a large degree of variability depending upon the laboratory used and the concentration of the spike. The variation of the samples by concentration were as follows:

	<i>Mean</i>	<i>Median</i>	<i>Mean Diff</i>	<i>Mean % Diff</i>	<i>Mean Abs Diff</i>	<i>Mean Abs % Diff</i>
0.4 µg Spike	0.3	0.3	0.1	16.4	0.2	62.2
4.0 µg Spike	2.5	2.7	1.5	37.1	2.1	53.2
5.0 µg Spike	4.0	4.1	1.0	20.9	1.6	31.8
40 µg Spike	33.3	33.9	6.7	16.7	18.1	45.2
50 µg Spike	37.6	37.0	12.4	24.9	20.0	40.1
120 µg Spike	101.6	113.2	30.4	24.5	54.3	41.8

These data show significant differences between the spike and the results. The sample results were generally reported as less than the actual spike and the mean difference ranged from 16% to as high as 25% with the absolute difference ranging from 10% to 62%. The data also varied significantly by laboratory with some laboratories reporting consistently lower results. The results of the study grouped by laboratory are as follows:

Minnesota Wipe Sample Round Robin Study - Variation by Laboratory

Lab	Spike Conc.	Results	Difference	% Difference	Abs Diff	Abs % Diff.
A	0.4	0.58	-0.18	-45.0	0.18	45.0
A	0.4	0.63	-0.23	-57.5	0.23	57.5

A		4	3.436		0.56	14.1	0.56	14.1
A		4	3.38		0.62	15.5	0.62	15.5
A		4	4.8		-0.80	-20.0	0.80	20.0
A		4	4.64		-0.64	-16.0	0.64	16.0
A		5	4.48		0.52	10.4	0.52	10.4
A		5	4.55		0.45	9.0	0.45	9.0
A		40	31.44		8.56	21.4	8.56	21.4
A		40	30.48		9.52	23.8	9.52	23.8
A		50	25.9		24.10	48.2	24.10	48.2
A		50	25.3		24.70	49.4	24.70	49.4
A		120	57.6		62.40	52.0	62.40	52.0
A		120	63.2		56.80	47.3	56.80	47.3
A		150	147		3.00	2.0	3.00	2.0
A	Blank		0.03	NA	NA	NA	NA	NA
A	Blank	ND		ND	ND	ND	ND	ND
A	Blank	ND		ND	ND	ND	ND	ND

Overall Mean

10.3

28.8

B		0.4	0.272		0.13	32.0	0.13	32.0
B		0.4	0.292		0.11	27.0	0.11	27.0
B		4	1.47		2.53	63.3	2.53	63.3
B		4	1.64		2.36	59.0	2.36	59.0
B		4	2.35		1.65	41.3	1.65	41.3
B		4	2.17		1.83	45.8	1.83	45.8
B		5	2.9		2.10	42.0	2.10	42.0
B		5	3		2.00	40.0	2.00	40.0
B		40	37.6		2.40	6.0	2.40	6.0
B		40	36.3		3.70	9.3	3.70	9.3
B		50	29		21.00	42.0	21.00	42.0
B		50	26.8		23.20	46.4	23.20	46.4
B		120	44		76.00	63.3	76.00	63.3
B		120	65.6		54.40	45.3	54.40	45.3
B		150	106.3		43.70	29.1	43.70	29.1
B	Blank		<0.01	NA	NA	NA	NA	NA
B	Blank		0.0267	NA	NA	NA	NA	NA
B	Blank	ND		ND	ND	ND	ND	ND

Overall Mean

39.4

39.4

C		0.4	0.66		-0.26	-65.0	0.26	65.0
C		0.4	0.73		-0.33	-82.5	0.33	82.5
C		4	4.3		-0.30	-7.5	0.30	7.5

C		4	4.6	-0.60	-15.0	0.60	15.0
C		4	6.3	-2.30	-57.5	2.30	57.5
C		4	6.3	-2.30	-57.5	2.30	57.5
C		5	6.4	-1.40	-28.0	1.40	28.0
C		5	6.4	-1.40	-28.0	1.40	28.0
C		40	61	-21.00	-52.5	21.00	52.5
C		40	60	-20.00	-50.0	20.00	50.0
C		50	69	-19.00	-38.0	19.00	38.0
C		50	70	-20.00	-40.0	20.00	40.0
C		120	150	-30.00	-25.0	30.00	25.0
C		120	160	-40.00	-33.3	40.00	33.3
C		150	270	-120.00	-80.0	120.00	80.0
C	Blank	ND	ND	ND	ND	ND	ND
C	Blank	ND	ND	ND	ND	ND	ND
C	Blank	ND	ND	ND	ND	ND	ND

Overall Mean

-44.0

44.0

D		0.4	0	0.40	100.0	0.40	100.0
D		0.4	0	0.40	100.0	0.40	100.0
D		4	0	4.00	100.0	4.00	100.0
D		4	0	4.00	100.0	4.00	100.0
D		4	0	4.00	100.0	4.00	100.0
D		4	0	4.00	100.0	4.00	100.0
D		5	0	5.00	100.0	5.00	100.0
D		5	0	5.00	100.0	5.00	100.0
D		40	16.8	23.20	58.0	23.20	58.0
D		40	6.4	33.60	84.0	33.60	84.0
D		50	0.2	49.80	99.6	49.80	99.6
D		50	0.1	49.90	99.8	49.90	99.8
D		120	11.2	108.80	90.7	108.80	90.7
D		120	31.2	88.80	74.0	88.80	74.0
D		150	0.5	149.50	99.7	149.50	99.7
D	Blank	ND	ND	ND	ND	ND	ND
D	Blank	ND	ND	ND	ND	ND	ND
D	Blank	ND	ND	ND	ND	ND	ND

Overall Mean

93.7

93.7

E		0.4	0.35	0.05	12.5	0.05	12.5
E		0.4	0.5	-0.10	-25.0	0.10	25.0
E		4	3.06	0.94	23.5	0.94	23.5
E		4	3.12	0.88	22.0	0.88	22.0

E		4	4.29	-0.29	-7.3	0.29	7.3
E		4	4.51	-0.51	-12.8	0.51	12.8
E		5	6	-1.00	-20.0	1.00	20.0
E		5	5.3	-0.30	-6.0	0.30	6.0
E		5	4.7	0.30	6.0	0.30	6.0
E		40	56.55	-16.55	-41.4	16.55	41.4
E		40	51.06	-11.06	-27.7	11.06	27.7
E		50	58.4	-8.40	-16.8	8.40	16.8
E		50	55.8	-5.80	-11.6	5.80	11.6
E		50	46.8	3.20	6.4	3.20	6.4
E		50	44.6	5.40	10.8	5.40	10.8
E		120	130.11	-10.11	-8.4	10.11	8.4
E		120	122.2	-2.20	-1.8	2.20	1.8
E		150	186.3	-36.30	-24.2	36.30	24.2
E		150	149.6	0.40	0.3	0.40	0.3
E	Blank	ND	ND	ND	ND	ND	ND
E	Blank	ND	ND	ND	ND	ND	ND
E	Blank	ND	ND	ND	ND	ND	ND
E	Blank	ND	ND	ND	ND	ND	ND

Overall Mean

-6.4

15.0

F		0.4	0	0.40	100.0	0.40	100.0
F		0.4	0	0.40	100.0	0.40	100.0
F		4	0	4.00	100.0	4.00	100.0
F		4	0	4.00	100.0	4.00	100.0
F		4	0	4.00	100.0	4.00	100.0
F		4	0	4.00	100.0	4.00	100.0
F		5	4.1	0.90	18.0	0.90	18.0
F		5	3.7	1.30	26.0	1.30	26.0
F		5	4.1	0.90	18.0	0.90	18.0
F		5	3.7	1.30	26.0	1.30	26.0
F		40	6.32	33.68	84.2	33.68	84.2
F		40	6.08	33.92	84.8	33.92	84.8
F		50	38	12.00	24.0	12.00	24.0
F		50	36	14.00	28.0	14.00	28.0
F		120	43.6	76.40	63.7	76.40	63.7
F		120	52.8	67.20	56.0	67.20	56.0
F		150	120	30.00	20.0	30.00	20.0
F		150	120	30.00	20.0	30.00	20.0
F	Blank	ND	ND	ND	ND	ND	ND
F	Blank	ND	ND	ND	ND	ND	ND
F	Blank	ND	ND	ND	ND	ND	ND

F	Blank	ND	ND	ND	ND	ND
Overall Mean				59.4	59.4	

ND = Non-Detect

NA = Not Applicable

Abs Diff. = Percent absolute difference

The best laboratory overall was Laboratory E with an overall absolute percent difference of 15%. Most of the laboratories had significant problems at the higher spike levels with many of the laboratories reporting less than ½ of the spike level. Only Laboratory C reported levels that were consistently higher than the spike concentration. Most labs reported levels that were much lower.

National Jewish Study:

Based upon the concerns that we have regarding the potential for false positives or false negatives, we proposed to answer the following questions in this study:

1. What is the variability within samples spiked with a 0.5 µg sample?
2. What is the variability within samples spiked with a 0.1 µg sample?
3. What is the variability within samples spiked with a 0.05 µg sample?
4. What is the rate of false positives for blank samples?
5. How does latex paint interfere with sample results?
6. How does dust interfere with sample results?
7. Are results using methanol different than results using isopropanol?
8. Is there a difference between Laboratories?

We were also interested in determining if false positive samples would be obtained from sampling actual structures where other household chemicals were routinely utilized.

Methodology

In order to obtain known spikes of methamphetamine, we obtained a methamphetamine chloride solution from Sigma Chemical (catalogue # M5260) that was at a concentration of 1.0 mg/ml +/- 5%. A dilution was made by taking a 50 µl aliquot of the solution and adding it to 100 ml of reagent grade methanol. The resulting solution was expected to result in a concentration of 0.5 µg/ml. The resulting solution was sent to a laboratory for analysis. The result from the laboratory came back at 0.31 µg/ml, slightly lower than the

predicted 0.5 µg/ml. Samples sent to other laboratories confirmed a lower than expected concentration and the 0.31 µg/ml concentration was utilized for the study calculations.

It was determined that the samples would be sent to three laboratories that were commonly utilized for the analysis of methamphetamine wipe samples. All of the laboratories use either liquid chromatography/mass spectrometry or gas chromatography/mass spectrometry. Samples were submitted according to the protocols for the laboratory to which they are to be sent. Laboratory A samples were submitted on 3x3 gauze sponges that were packed into a 50 ml plastic centrifuge tube. Both the sponges and the centrifuge tubes were provided by the laboratory. Laboratory B samples were obtained using Whatman 40 filter paper and then placed in sterile jars and then into an ice chest for shipment. The filters, jars, and ice chest were provided by the laboratory. Laboratory C samples were also collected using Whatman Filters and placed into 20 ml vials, both of which were provided by the laboratory.

Samples to determine the influence of paint were obtained by sampling a piece of drywall that had been painted with a green latex paint using the solvent appropriate for that wipe (isopropanol or methanol). The samples were then spiked with the appropriate amount of methamphetamine (0.3µg, 0.06 µg, 0.03 µg, or no spike) using a micropipette. To obtain the desired concentrations, the samples were spiked with 1000 µl, 200 µl and 100 µl to obtain the 0.3 µg, 0.06 µg, and 0.03 µg per wipe concentrations.

Samples to determine the influence of dust were wiped on a smooth dusty surface using the solvent appropriate for that wipe (isopropanol or methanol) and then spiked with the appropriate amount of methamphetamine (0.3µg, 0.06 µg, 0.03 µg, or no spike) using a micropipette. To obtain the desired concentrations, the samples were spiked with 1000 µl, 200 µl and 100 µl to obtain the 0.3 µg, 0.06 µg, and 0.03 µg per wipe concentrations.

Samples with no dust or paint were unpackaged and then spiked with the appropriate amount of methamphetamine (0.5µg, 0.1 µg, 0.05 µg, or 0.0 µg) using a micropipette. To obtain the desired concentrations, the samples were spiked with 1000 µl, 200 µl and 100 µl to obtain the 0.3 µg, 0.06 µg, and 0.03 µg per wipe concentrations.

The largest number of samples were sent to Laboratory A since that laboratory is within the State of Utah and is commonly used for methamphetamine wipe sample analysis.

In order to identify the differences between laboratories, samples were also sent to two other laboratories in Washington State (Laboratory B and Laboratory C) that are commonly used for methamphetamine analysis by the State of Washington.

A second portion of the study was to determine if wipe samples taken in occupied structures would test positive for methamphetamine due to other normal contaminants. This is somewhat difficult to determine since many structures may have been utilized for methamphetamine smoking without the knowledge of the owner. It was felt, however, that if a structure was known not to have had meth cooked or used within the structure during the last 10 years, it was likely methamphetamine free. This assumption is based

on the belief that methamphetamine manufacture and use did not become popular in Colorado until after the mid 1990's.

Based on this assumption a total of 3 structures were tested for methamphetamine using methanol as a solvent and the sampling media provided by the laboratory to which the samples were sent. One structure was sampled twice with one set of samples being sent to a laboratory in Utah (Laboratory A) and the other set sent to a laboratory in Washington State (Laboratory C). Except for that one structure, all other samples obtained were sent to Laboratory A. Samples for each structure were obtained on the following surfaces:

- 2 samples on a smooth glass surface.
- 2 samples from the top of a refrigerator or other appliance with an enamel surface.
- 2 samples from a painted drywall surface.
- 2 samples from a wood surface.
- 2 samples from a tile or similar floor.
- 2 blank samples.

All samples were taken using the media provided by the laboratory (4x4 wipes from Laboratory A and Whatman filters from Laboratory C.). The sample was collected using a 100 cm² template for each sample. Both samples of the pair were taken next to each other using a up and down and side to side pattern. Each media piece was wetted using 1ml - 2 ml of reagent grade methanol for each sample. Immediately after taking each sample, the media was put into the container provided by the laboratory (plastic centrifuge tubes for Laboratory A and glass vials for Laboratory C). All samples were packaged and sent to the laboratory on the day of sampling using overnight delivery.

Results

Sampling Variability:

The initial portion of the study (performance of the 3 laboratories) resulted in the submission of a total of 142 samples. Forty-nine of the samples were blank samples and the rest were spiked with a known amount of methamphetamine. Thirty-four of the samples were spiked with 0.03 µg/sample, 34 were spiked with 0.06 µg/sample, and 25 were spiked with 0.3 µg/sample.

Laboratory A had a quantification limit of 0.05 µg/sample and a reporting limit of 0.1 µg/sample. We requested that all results be reported at the 0.05 µg/sample reporting limit

so that we could observe the accuracy of their analysis at the lower levels. Laboratory B had a reporting and quantification level of 0.05 µg/sample and Laboratory C had a reporting and quantification limit of 0.03 µg/sample. Therefore, the 0.03 µg spikes would be considered as blanks for all but Laboratory C. A listing of all of the 142 samples is provided at the end of the report.

The results of the blank (un-spiked) samples were as follows:

Sample	Lab	Sample Description	Spike Amount	Solvent	Result
1	Lab A	wipe without contamination	0	Methanol	<0.05
7	Lab A	wipe without contamination	0	Methanol	<0.05
15	Lab A	wipe without contamination	0	Methanol	<0.05
16	Lab A	wipe without contamination	0	Methanol	<0.05
71	Lab A	Dust Contamination	0	Isopropanol	<0.05
72	Lab A	Dust Contamination	0	Isopropanol	<0.05
73	Lab A	Dust Contamination	0	Isopropanol	<0.05
74	Lab A	Dust Contamination	0	Isopropanol	<0.05
75	Lab A	Dust Contamination	0	Isopropanol	<0.05
40	Lab A	Dust Contamination	0	Methanol	<0.05
76	Lab A	Dust Contamination	0	Methanol	<0.05
77	Lab A	Dust Contamination	0	Methanol	<0.05
78	Lab A	Dust Contamination	0	Methanol	<0.05
79	Lab A	Dust Contamination	0	Methanol	<0.05
80	Lab A	Dust Contamination	0	Methanol	<0.05
31	Lab A	Paint contamination	0	Isopropanol	<0.05
32	Lab A	Paint contamination	0	Isopropanol	<0.05
33	Lab A	Paint contamination	0	Isopropanol	<0.05
34	Lab A	Paint contamination	0	Isopropanol	<0.05
35	Lab A	Paint contamination	0	Isopropanol	<0.05
36	Lab A	Paint contamination	0	Methanol	<0.05
37	Lab A	Paint contamination	0	Methanol	<0.05
38	Lab A	Paint contamination	0	Methanol	<0.05
39	Lab A	Paint contamination	0	Methanol	<0.05
86	Lab A	wipe without contamination	0	None	<0.05
87	Lab A	wipe without contamination	0	None	<0.05
88	Lab A	wipe without contamination	0	None	<0.05
89	Lab A	wipe without contamination	0	None	<0.05
90	Lab A	wipe without contamination	0	None	<0.05
13	Lab B	Paint contamination	0	Isopropanol	ND
14	Lab B	Paint contamination	0	Isopropanol	ND
15	Lab B	Paint contamination	0	Isopropanol	ND

11	Lab B	Paint contamination	0	Methanol	ND
12	Lab B	Paint contamination	0	Methanol	ND
19	Lab B	wipe without contamination	0	Isopropanol	ND
20	Lab B	wipe without contamination	0	Isopropanol	ND
16	Lab B	wipe without contamination	0	Methanol	ND
17	Lab B	wipe without contamination	0	Methanol	ND
18	Lab B	wipe without contamination	0	Methanol	ND
13	Lab C	Dust Contamination	0	Isopropanol	<0.030
14	Lab C	Dust Contamination	0	Isopropanol	<0.030
15	Lab C	Dust Contamination	0	Isopropanol	<0.030
11	Lab C	Dust Contamination	0	Methanol	<0.030
12	Lab C	Dust Contamination	0	Methanol	<0.030
19	Lab C	wipe without contamination	0	Isopropanol	<0.030
20	Lab C	wipe without contamination	0	Isopropanol	<0.030
16	Lab C	wipe without contamination	0	Methanol	<0.030
17	Lab C	wipe without contamination	0	Methanol	<0.030
18	Lab C	wipe without contamination	0	Methanol	<0.030

Count 49
ND = Non Detect

As can be seen, none of the samples resulted in a positive result from any of the laboratories. The type of contamination and the type of solvent utilized appeared to have no effect upon the results. The samples spiked with 0.03 µg of methamphetamine were also blanks for all but one laboratory. The results obtained from these samples were as follows:

Sample	Lab	Sample Description	Spike Amount	Solvent	Result
2	Lab A	wipe without contamination	0.03	Methanol	<0.05
8	Lab A	wipe without contamination	0.03	Methanol	<0.05
9	Lab A	wipe without contamination	0.03	Methanol	<0.05
13	Lab A	wipe without contamination	0.03	Methanol	<0.05
41	Lab A	Dust Contamination	0.03	Isopropanol	<0.05
42	Lab A	Dust Contamination	0.03	Isopropanol	<0.05
43	Lab A	Dust Contamination	0.03	Isopropanol	<0.05
44	Lab A	Dust Contamination	0.03	Isopropanol	<0.05
45	Lab A	Dust Contamination	0.03	Isopropanol	<0.05
46	Lab A	Dust Contamination	0.03	Methanol	<0.05
47	Lab A	Dust Contamination	0.03	Methanol	<0.05
48	Lab A	Dust Contamination	0.03	Methanol	<0.05
49	Lab A	Dust Contamination	0.03	Methanol	<0.05
50	Lab A	Dust Contamination	0.03	Methanol	<0.05

1	Lab A	Paint contamination	0.03	Isopropanol	<0.05
2	Lab A	Paint contamination	0.03	Isopropanol	<0.05
3	Lab A	Paint contamination	0.03	Isopropanol	<0.05
4	Lab A	Paint contamination	0.03	Isopropanol	<0.05
5	Lab A	Paint contamination	0.03	Isopropanol	<0.05
6	Lab A	Paint contamination	0.03	Methanol	<0.05
7	Lab A	Paint contamination	0.03	Methanol	<0.05
8	Lab A	Paint contamination	0.03	Methanol	<0.05
9	Lab A	Paint contamination	0.03	Methanol	<0.05
10	Lab A	Paint contamination	0.03	Methanol	<0.05
3	Lab B	Paint contamination	0.03	Isopropanol	<0.05
4	Lab B	Paint contamination	0.03	Isopropanol	<0.05
5	Lab B	Paint contamination	0.03	Isopropanol	ND
1	Lab B	Paint contamination	0.03	Methanol	ND
2	Lab B	Paint contamination	0.03	Methanol	ND
3	Lab C	Dust Contamination	0.03	Isopropanol	0.038
4	Lab C	Dust Contamination	0.03	Isopropanol	0.038
5	Lab C	Dust Contamination	0.03	Isopropanol	0.037
1	Lab C	Dust Contamination	0.03	Methanol	0.036

ND = Non Detect

These results again were below the detection limit except for the laboratory that was capable of reporting at the 0.03 µg/sample level. That laboratory reported a detection for all of the samples. The reported amount ranged from 0.036 µg/sample to 0.038 µg/sample. Although these results amount to a reported level that may exceed the actual level present by as much as 23% ($0.007\mu\text{g}/0.03\mu\text{g} \times 100$), The actual difference of 7 picograms/sample is extremely small and Laboratory C's results are extremely close to the actual sample results.

The samples that were spiked at the 0.06 µg level were meant to determine the individual laboratory's ability to report a level that was just slightly above the level of quantification. The results of this sampling were as follows:

Sample	Lab	Sample Description	Spike Amount	Solvent	Result	Diff.	% diff
3	Lab A	No contamination	0.06	Methanol	0.057	0.003	5.0
6	Lab A	No contamination	0.06	Methanol	0.055	0.005	8.3
10	Lab A	No contamination	0.06	Methanol	0.056	0.004	6.7
12	Lab A	No contamination	0.06	Methanol	0.058	0.002	3.3
51	Lab A	Dust Contamination	0.06	Isopropanol	0.055	0.005	8.3
52	Lab A	Dust Contamination	0.06	Isopropanol	0.059	0.001	1.7
53	Lab A	Dust Contamination	0.06	Isopropanol	0.06	0.000	0.0
54	Lab A	Dust Contamination	0.06	Isopropanol	0.058	0.002	3.3
55	Lab A	Dust Contamination	0.06	Isopropanol	0.058	0.002	3.3

56	Lab A	Dust Contamination	0.06	Methanol	0.057	0.003	5.0
57	Lab A	Dust Contamination	0.06	Methanol	0.057	0.003	5.0
58	Lab A	Dust Contamination	0.06	Methanol	0.06	0.000	0.0
59	Lab A	Dust Contamination	0.06	Methanol	0.055	0.005	8.3
60	Lab A	Dust Contamination	0.06	Methanol	0.058	0.002	3.3
11	Lab A	Paint contamination	0.06	Isopropanol	0.054	0.006	10.0
12	Lab A	Paint contamination	0.06	Isopropanol	0.064	0.004	6.7
13	Lab A	Paint contamination	0.06	Isopropanol	0.057	0.003	5.0
14	Lab A	Paint contamination	0.06	Isopropanol	0.056	0.004	6.7
15	Lab A	Paint contamination	0.06	Isopropanol	0.057	0.003	5.0
16	Lab A	Paint contamination	0.06	Methanol	0.051	0.009	15.0
17	Lab A	Paint contamination	0.06	Methanol	0.061	0.001	1.7
18	Lab A	Paint contamination	0.06	Methanol	0.058	0.002	3.3
19	Lab A	Paint contamination	0.06	Methanol	0.062	0.002	3.3
20	Lab A	Paint contamination	0.06	Methanol	0.059	0.001	1.7
9	Lab B	Paint contamination	0.06	Isopropanol	ND	NA	NA
10	Lab B	Paint contamination	0.06	Isopropanol	ND	NA	NA
6	Lab B	Paint contamination	0.06	Methanol	0.05	0.010	16.7
7	Lab B	Paint contamination	0.06	Methanol	0.05	0.010	16.7
8	Lab B	Paint contamination	0.06	Methanol	0.05	0.010	16.7
9	Lab C	Dust Contamination	0.06	Isopropanol	0.077	0.017	28.3
10	Lab C	Dust Contamination	0.06	Isopropanol	0.099	0.039	65.0
6	Lab C	Dust Contamination	0.06	Methanol	0.058	0.002	3.3
7	Lab C	Dust Contamination	0.06	Methanol	0.075	0.015	25.0
8	Lab C	Dust Contamination	0.06	Methanol	0.079	0.019	31.7
Count					32	32.000	32.0
Mean					0.06	0.006	10.1
Median					0.058	0.003	5.0
STD					0.0099	0.008	12.8

NA = Not Applicable

These results indicate that most laboratories were very close to the spiked amount. The amounts reported ranged from 0.05 µg/sample to as high as 0.099 µg/sample. The mean level reported from all labs was 0.06 µg/sample and the median was 0.058 µg/sample. The mean difference was 0.006 µg/sample and the median difference was 0.003 µg/sample. The percent difference between the reported sample results and the actual sample results ranged from 0 % difference to a high of 65% difference. The mean percent difference, however, was only 10.1% and the median was 5%. These results indicate that most labs and samples were very close to the spiked amount. Laboratory C had the worst results in these samples with most of the results being higher than the actual amount of methamphetamine present.

The results of the samples that were spiked at the 0.3 µg/sample level were as follows:

Sample	Lab	Sample Description	Spike Amount	Solvent	Result	Diff	% Diff.
21	Lab A	Paint contamination	0.3	Isopropanol	0.3	0.00	0.0
22	Lab A	Paint contamination	0.3	Isopropanol	0.34	0.04	13.3
23	Lab A	Paint contamination	0.3	Isopropanol	0.34	0.04	13.3
24	Lab A	Paint contamination	0.3	Isopropanol	0.35	0.05	16.7
25	Lab A	Paint contamination	0.3	Isopropanol	0.37	0.07	23.3
61	Lab A	Dust Contamination	0.3	Isopropanol	0.33	0.03	10.0
62	Lab A	Dust Contamination	0.3	Isopropanol	0.35	0.05	16.7
63	Lab A	Dust Contamination	0.3	Isopropanol	0.34	0.04	13.3
64	Lab A	Dust Contamination	0.3	Isopropanol	0.36	0.06	20.0
65	Lab A	Dust Contamination	0.3	Isopropanol	0.34	0.04	13.3
4	Lab A	No contamination	0.3	Methanol	0.31	0.01	3.3
5	Lab A	No contamination	0.3	Methanol	0.33	0.03	10.0
11	Lab A	No contamination	0.3	Methanol	0.33	0.03	10.0
14	Lab A	No contamination	0.3	Methanol	0.31	0.01	3.3
17	Lab A	1 ml of .3 µg/ml spike	0.3	Methanol	0.31	0.01	3.3
26	Lab A	Paint contamination	0.3	Methanol	0.31	0.01	3.3
27	Lab A	Paint contamination	0.3	Methanol	0.34	0.04	13.3
28	Lab A	Paint contamination	0.3	Methanol	0.36	0.06	20.0
29	Lab A	Paint contamination	0.3	Methanol	0.36	0.06	20.0
30	Lab A	Paint contamination	0.3	Methanol	0.36	0.06	20.0
66	Lab A	Dust Contamination	0.3	Methanol	0.31	0.01	3.3
67	Lab A	Dust Contamination	0.3	Methanol	0.35	0.05	16.7
68	Lab A	Dust Contamination	0.3	Methanol	0.33	0.03	10.0
69	Lab A	Dust Contamination	0.3	Methanol	0.37	0.07	23.3
70	Lab A	Dust Contamination	0.3	Methanol	0.34	0.04	13.3
Count					25	25	25
Average					0.34	0.04	12.5
Median					0.34	0.04	13.3
Minimum					0.30	0.00	0.0
Maximum					0.37	0.07	23.3
St. Dev.					0.02	0.02	6.8

Spike samples at this concentration were only submitted to Laboratory A. The results were very close to the spiked amount with the mean and median level found to be 0.34 µg/sample. The samples ranged from 0.3 µg/sample to a high of 0.37 µg/sample. The percent difference ranged from no difference to only 23.3% difference. The mean percent difference was 12.5% and the median percent difference was 13.3 µg/sample.

A comparison between the two different solvents was conducted to determine if either isopropanol or methanol would result in an additional interference with the methamphetamine analysis. This portion of the project was not to determine which solvent best removes the methamphetamine from a sampled surface but just does the use of either solvent alter the results. The results of the solvent sampling were as follows:

<i>Solvent</i>	<i>0.06 spike mean (µg/sample)</i>	<i>0.3 spike mean (µg/sample)</i>	<i>0.06 Percent Difference</i>	<i>0.3 Percent Difference</i>
Isopropanol	0.063	0.342	4.7	14.0
Methanol	0.058	0.335	2.8	11.6

These data show that the use of either isopropanol or methanol result in very similar mean results for either spike levels. In addition, the percent difference or variability between sample results were also similar (14.0 % and 11.6 %). Based on this information, it appears that there is no interference when using either isopropanol or methanol.

We also compared the type of contamination on the wipe over the different spike levels. This comparison was designed to determine if the presence of either dust or paint on the wipe interfered with the laboratory analysis of the sample. The results of this comparison were as follows:

<i>Contaminant</i>	<i>0.06 spike mean (µg/sample)</i>	<i>0.3 spike mean (µg/sample)</i>	<i>0.06 Percent Difference</i>	<i>0.3 Percent Difference</i>	<i>Total Median % Difference</i>
None	0.057	0.320	5.8	6.7	5.8
Dust	0.064	0.342	12.8	14.0	10.0
Paint	0.056	0.343	8.3	14.3	13.3

These results indicate that the presence or absence of dust or paint on the wipe does not result in a significant difference in the result since the means for the samples are very similar for all three cases. There did appear to be more variability among the samples with paint or dust contamination than was observed in the samples without any contamination.

We also attempted to compare the three different laboratories that were involved with the sampling. Since most of the samples were submitted to a single laboratory, a straight comparison of the samples may not be appropriate. However, the results of the comparison were as follows:

<i>Laboratory</i>	<i>0.06 spike mean (µg/sample)</i>	<i>0.3 spike mean (µg/sample)</i>	<i>0.06 Percent Difference</i>	<i>0.3 Percent Difference</i>	<i>Total Median % Difference</i>
A	0.058	0.34	5.0	12.5	6.7
B	0.050	ND	16.7	ND	16.6

C	0.078	ND	26.7	ND	26.7
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Spikes containing 0.3 µg of methamphetamine were only sent to Laboratory A, which is the laboratory most often utilized by Utah contractors. At the 0.06 µg spike level, most of the laboratories were very similar with only Laboratory C showing slightly higher results than did Laboratory A and Laboratory B. In terms of sample variability, Laboratory A also had the least variability but they also had the highest number of samples. It appears that all of the laboratories are generally within a range of plus or minus 30% of the actual sample value.

Structure Testing Results:

A total of 48 samples were submitted to two laboratories, one in Utah (Laboratory A) and one in Washington State (Laboratory C). Twelve samples were sent to Laboratory C and 36 samples were sent to Laboratory A. The samples were taken from glass surfaces, painted drywall surfaces, appliance surfaces, tile floors, and wood surfaces. In addition, two blanks were also submitted. The results are attached to the end of this report. All of the samples submitted were found to be below the detection limit at both laboratories. These data indicate that samples obtained at homes not contaminated with methamphetamine will be reported as below the detection limit.

Conclusions

At the beginning of this study, we set out to answer the following questions:

1. What is the variability within samples spiked with a 0.3 µg sample?
2. What is the variability within samples spiked with a 0.06 µg sample?
3. What is the variability within samples spiked with a 0.03 µg sample?
4. What is the rate of false positives for blank samples?
5. How does latex paint interfere with sample results?
6. How does dust interfere with sample results?
7. Are results using methanol different than results using isopropanol?
8. Is there a difference between Laboratories?
9. Will occupied structures test negative if methamphetamine is not present?

Initial studies conducted by the State of Minnesota suggested that very few blanks would be reported as false positives (2/20 samples, 10%) and of those reported as positive, they would likely be close to the level of detection (0.03 µg). Our sampling data taken during our initial methamphetamine laboratory project had resulted in a total of two blank samples being reported as positive out of 55 samples taken for a false positive rate of 4%. One of these samples was relatively low (0.1 µg) while one was relatively high (5.7 µg). Since these samples were taken during field sampling conditions, it is very possible that samples were switched or mislabeled. Even if we assume that these samples were, in fact, false positive samples, the false positive rate for both of these studies would only be 5% (4/75).

During this study, we submitted blanks during different phases of the project. A total of 49 blank samples were submitted in the first phase of the study (sampling variability study) while another 48 samples were submitted during the structure evaluation phase. None of these samples resulted in a false positive. In addition, another 34 samples were submitted that had been spiked with a 0.03 µg spike. Only one laboratory had a reporting limit down to that level, so for other laboratories, these samples would account for another 30 blanks. Based on this information, we submitted a total of 127 blanks of which none were reported as a false positive.

If all of the samples are combined, a total of four false positives were found in a total of 202 samples for a false positive rate of 2%. It is likely, however, that the laboratories have become significantly better since the Minnesota study and again it is quite possible that the samples recorded as false positives in our field study were switched samples. If that is the case, it is possible that there is a very low possibility of finding a false positive. In addition, our study indicated that the presence of isopropanol or methanol also does not result in a false positive nor does the presence of latex paint or dust. This finding is important since these compounds are common contaminants in wipe samples submitted for analysis.

During our sampling effort, we also submitted a number of known spikes to three different laboratories for analysis. The submitted spikes were at relatively low levels 0.03 µg to 0.3 µg since we were more interested in the variability at the levels one might encounter during cleanup operations. Minnesota had found a large degree of variability in many of these samples. The mean absolute differences observed in their study ranged from 31% to 62% with the largest variation at the low spike levels. Our study did not reveal such large variations. The mean absolute differences ranged from 10% in the 0.06 µg spikes to 12.5% in the 0.3 µg spikes. Again the different types of solvents and different contaminants did not appear to make a difference in the variability observed in the blank levels submitted. In most cases, the amount of sample reported will be within +/- 30% of the actual value of the sample.

During both the Minnesota testing and our testing, the variability between laboratories was measurable. Minnesota reported large differences between the laboratories with some laboratories not even reporting methamphetamine on spike samples. Our study did not reveal such large differences. Although all three laboratories had different

methodologies for the submission of samples, all three laboratories were fairly accurate on their reporting. The most samples were submitted to Laboratory A since that laboratory is the most common laboratory utilized in the State of Utah. That laboratory provided very good results with the mean for a 0.06 µg spike of 0.058 µg and a mean for a 0.3 µg spike of 0.34 µg. The other laboratories were also very close to the actual amounts submitted. These data suggest that either analytical methods have significantly improved since the Minnesota tests, or the laboratories that we utilized in this sampling plan were more accurate than the laboratories that were tested by Minnesota.

Based upon the data that we obtained, the answers to our initial questions are as follows:

What is the rate of false positives for blank samples?

The rate of false positives samples during this study were 0%. The false positive rate based upon all samples that we have submitted and all that Minnesota have submitted is 2%. The actual false positive rate is likely less than 2% and is likely closer to 0%.

What is the variability within samples spiked with a 0.03 µg sample?

Most laboratories considered this level below their reporting limit. All but one laboratory reported these samples as non-detect. The one laboratory that did report at this level reported levels ranging from 0.036 µg/sample to 0.038 µg/sample. The actual difference was only 7 picograms per sample.

What is the variability within samples spiked with a 0.06 µg sample?

Spike samples submitted to all three laboratories had a mean of 0.06 µg/sample with a median of 0.058 µg/sample. The range was 0.05 µg/sample to 0.099 µg/sample with an absolute percent difference of 10% and a range of 0% to 65%. In general, the differences conform very well to the spiked amount.

What is the variability within samples spiked with a 0.3 µg sample?

The samples spiked with 0.3 µg were only sent to Laboratory A and resulted in a mean reported level of 0.34 µg/sample and a median level of 0.34 µg/sample. The absolute percent difference was an average of 12.5% and ranged from 0% to 23.3%. This variation is well within the +/- 30% range that is frequently used.

How does latex paint interfere with sample results?

Latex paint does not interfere with blank samples and does not appear to influence the level of methamphetamine that will be reported on a sample.

How does dust interfere with sample results?

The presence of dust on sampling media does not appear to interfere with blank samples and does not result in a change in the amount of methamphetamine per sample reported by the laboratory.

Are results using methanol different than results using isopropanol?

The presence of methanol or isopropanol on the sampling media does not influence the level of methamphetamine reported and does not result in a higher false positive rate.

Will occupied structures test negative if methamphetamine is not present?

Occupied structures will not test positive for methamphetamine under the conditions tested.

Is there a difference between Laboratories?

There does appear to be a difference between laboratories but all of the laboratories tested during this project had 0% false positive rates and all reported methamphetamine levels that were very close to the actual spike level. The laboratories all had average absolute percent differences of less than 30% for the spike samples that were submitted. It is very likely that field practices will result in a larger variability than will the laboratories.

List of all Samples Taken

Sampling Variability Project Data Sheet

Sample	Lab	Sample Description	Spike Amount	Solvent	Result
1	A	wipe without contamination	0	Methanol	<0.05
7	A	wipe without contamination	0	Methanol	<0.05
15	A	wipe without contamination	0	Methanol	<0.05
16	A	wipe without contamination	0	Methanol	<0.05
71	A	Dust Contamination	0	Isopropanol	<0.05
72	A	Dust Contamination	0	Isopropanol	<0.05
73	A	Dust Contamination	0	Isopropanol	<0.05
74	A	Dust Contamination	0	Isopropanol	<0.05
75	A	Dust Contamination	0	Isopropanol	<0.05
40	A	Dust Contamination	0	Methanol	<0.05
76	A	Dust Contamination	0	Methanol	<0.05
77	A	Dust Contamination	0	Methanol	<0.05
78	A	Dust Contamination	0	Methanol	<0.05
79	A	Dust Contamination	0	Methanol	<0.05
80	A	Dust Contamination	0	Methanol	<0.05
31	A	Paint contamination	0	Isopropanol	<0.05
32	A	Paint contamination	0	Isopropanol	<0.05
33	A	Paint contamination	0	Isopropanol	<0.05
34	A	Paint contamination	0	Isopropanol	<0.05
35	A	Paint contamination	0	Isopropanol	<0.05
36	A	Paint contamination	0	Methanol	<0.05
37	A	Paint contamination	0	Methanol	<0.05
38	A	Paint contamination	0	Methanol	<0.05
39	A	Paint contamination	0	Methanol	<0.05
86	A	wipe without contamination	0	None	<0.05
87	A	wipe without contamination	0	None	<0.05
88	A	wipe without contamination	0	None	<0.05
89	A	wipe without contamination	0	None	<0.05
90	A	wipe without contamination	0	None	<0.05
13	B	Paint contamination	0	Isopropanol	ND
14	B	Paint contamination	0	Isopropanol	ND
15	B	Paint contamination	0	Isopropanol	ND
11	B	Paint contamination	0	Methanol	ND
12	B	Paint contamination	0	Methanol	ND
19	B	wipe without contamination	0	Isopropanol	ND
20	B	wipe without contamination	0	Isopropanol	ND

16	B	wipe without contamination	0	Methanol	ND
17	B	wipe without contamination	0	Methanol	ND
18	B	wipe without contamination	0	Methanol	ND
13	C	Dust Contamination	0	Isopropanol	<0.030
14	C	Dust Contamination	0	Isopropanol	<0.030
15	C	Dust Contamination	0	Isopropanol	<0.030
11	C	Dust Contamination	0	Methanol	<0.030
12	C	Dust Contamination	0	Methanol	<0.030
19	C	wipe without contamination	0	Isopropanol	<0.030
20	C	wipe without contamination	0	Isopropanol	<0.030
16	C	wipe without contamination	0	Methanol	<0.030
17	C	wipe without contamination	0	Methanol	<0.030
18	C	wipe without contamination	0	Methanol	<0.030
2	A	wipe without contamination	0.03	Methanol	<0.05
8	A	wipe without contamination	0.03	Methanol	<0.05
9	A	wipe without contamination	0.03	Methanol	<0.05
13	A	wipe without contamination	0.03	Methanol	<0.05
41	A	Dust Contamination	0.03	Isopropanol	<0.05
42	A	Dust Contamination	0.03	Isopropanol	<0.05
43	A	Dust Contamination	0.03	Isopropanol	<0.05
44	A	Dust Contamination	0.03	Isopropanol	<0.05
45	A	Dust Contamination	0.03	Isopropanol	<0.05
46	A	Dust Contamination	0.03	Methanol	<0.05
47	A	Dust Contamination	0.03	Methanol	<0.05
48	A	Dust Contamination	0.03	Methanol	<0.05
49	A	Dust Contamination	0.03	Methanol	<0.05
50	A	Dust Contamination	0.03	Methanol	<0.05
1	A	Paint contamination	0.03	Isopropanol	<0.05
2	A	Paint contamination	0.03	Isopropanol	<0.05
3	A	Paint contamination	0.03	Isopropanol	<0.05
4	A	Paint contamination	0.03	Isopropanol	<0.05
5	A	Paint contamination	0.03	Isopropanol	<0.05
6	A	Paint contamination	0.03	Methanol	<0.05
7	A	Paint contamination	0.03	Methanol	<0.05
8	A	Paint contamination	0.03	Methanol	<0.05
9	A	Paint contamination	0.03	Methanol	<0.05
10	A	Paint contamination	0.03	Methanol	<0.05
3	B	Paint contamination	0.03	Isopropanol	<0.05
4	B	Paint contamination	0.03	Isopropanol	<0.05
5	B	Paint contamination	0.03	Isopropanol	ND
1	B	Paint contamination	0.03	Methanol	ND
2	B	Paint contamination	0.03	Methanol	ND
3	C	Dust Contamination	0.03	Isopropanol	0.038

4	C	Dust Contamination	0.03	Isopropanol	0.038
5	C	Dust Contamination	0.03	Isopropanol	0.037
1	C	Dust Contamination	0.03	Methanol	0.036
2	C	Dust Contamination	0.03	Methanol	0.039
3	A	wipe without contamination	0.06	Methanol	0.057
6	A	wipe without contamination	0.06	Methanol	0.055
10	A	wipe without contamination	0.06	Methanol	0.056
12	A	wipe without contamination	0.06	Methanol	0.058
51	A	Dust Contamination	0.06	Isopropanol	0.055
52	A	Dust Contamination	0.06	Isopropanol	0.059
53	A	Dust Contamination	0.06	Isopropanol	0.06
54	A	Dust Contamination	0.06	Isopropanol	0.058
55	A	Dust Contamination	0.06	Isopropanol	0.058
56	A	Dust Contamination	0.06	Methanol	0.057
57	A	Dust Contamination	0.06	Methanol	0.057
58	A	Dust Contamination	0.06	Methanol	0.06
59	A	Dust Contamination	0.06	Methanol	0.055
60	A	Dust Contamination	0.06	Methanol	0.058
11	A	Paint contamination	0.06	Isopropanol	0.054
12	A	Paint contamination	0.06	Isopropanol	0.064
13	A	Paint contamination	0.06	Isopropanol	0.057
14	A	Paint contamination	0.06	Isopropanol	0.056
15	A	Paint contamination	0.06	Isopropanol	0.057
16	A	Paint contamination	0.06	Methanol	0.051
17	A	Paint contamination	0.06	Methanol	0.061
18	A	Paint contamination	0.06	Methanol	0.058
19	A	Paint contamination	0.06	Methanol	0.062
20	A	Paint contamination	0.06	Methanol	0.059
9	B	Paint contamination	0.06	Isopropanol	ND
10	B	Paint contamination	0.06	Isopropanol	ND
6	B	Paint contamination	0.06	Methanol	0.05
7	B	Paint contamination	0.06	Methanol	0.05
8	B	Paint contamination	0.06	Methanol	0.05
9	C	Dust Contamination	0.06	Isopropanol	0.077
10	C	Dust Contamination	0.06	Isopropanol	0.099
6	C	Dust Contamination	0.06	Methanol	0.058
7	C	Dust Contamination	0.06	Methanol	0.075
8	C	Dust Contamination	0.06	Methanol	0.079
17	A	1 ml of .5 ug/ml spike	0.3	Methanol	0.31
4	A	wipe without contamination	0.3	Methanol	0.31
5	A	wipe without contamination	0.3	Methanol	0.33
11	A	wipe without contamination	0.3	Methanol	0.33
14	A	wipe without contamination	0.3	Methanol	0.31

61	A	Dust Contamination	0.3	Isopropanol	0.33
62	A	Dust Contamination	0.3	Isopropanol	0.35
63	A	Dust Contamination	0.3	Isopropanol	0.34
64	A	Dust Contamination	0.3	Isopropanol	0.36
65	A	Dust Contamination	0.3	Isopropanol	0.34
66	A	Dust Contamination	0.3	Methanol	0.31
67	A	Dust Contamination	0.3	Methanol	0.35
68	A	Dust Contamination	0.3	Methanol	0.33
69	A	Dust Contamination	0.3	Methanol	0.37
70	A	Dust Contamination	0.3	Methanol	0.34
21	A	Paint contamination	0.3	Isopropanol	0.3
22	A	Paint contamination	0.3	Isopropanol	0.34
23	A	Paint contamination	0.3	Isopropanol	0.34
24	A	Paint contamination	0.3	Isopropanol	0.35
25	A	Paint contamination	0.3	Isopropanol	0.37
26	A	Paint contamination	0.3	Methanol	0.31
27	A	Paint contamination	0.3	Methanol	0.34
28	A	Paint contamination	0.3	Methanol	0.36
29	A	Paint contamination	0.3	Methanol	0.36
30	A	Paint contamination	0.3	Methanol	0.36

Results of the Structure Sampling Results

Structure Sampling Results

Sample #	Location	Sampled Surface	Laboratory	Sampled Area	Result
1WJ	John's House	Glass	Laboratory B	100 cm ²	<0.03 ug
2WJ	John's House	Glass	Laboratory B	100 cm ²	<0.03 ug
3WJ	John's House	Stove	Laboratory B	100 cm ²	<0.03 ug
4WJ	John's House	Stove	Laboratory B	100 cm ²	<0.03 ug

5WJ	John's House	Painted Drywall	Laboratory B	100 cm ²	<0.03 ug
6WJ	John's House	Painted Drywall	Laboratory B	100 cm ²	<0.03 ug
7WJ	John's House	Wood	Laboratory B	100 cm ²	<0.03 ug
8WJ	John's House	Wood	Laboratory B	100 cm ²	<0.03 ug
9WJ	John's House	Tile	Laboratory B	100 cm ²	<0.03 ug
10WJ	John's House	Tile	Laboratory B	100 cm ²	<0.03 ug
11WJ	John's House	Blank	Laboratory B	100 cm ²	<0.03 ug
12WJ	John's House	Blank	Laboratory B	100 cm ²	<0.03 ug
1CJ	John's House	Glass	Laboratory A	100 cm ²	<0.05 ug
2CJ	John's House	Glass	Laboratory A	100 cm ²	<0.05 ug
3CJ	John's House	Stove	Laboratory A	100 cm ²	<0.05 ug
4CJ	John's House	Stove	Laboratory A	100 cm ²	<0.05 ug
5CJ	John's House	Painted Drywall	Laboratory A	100 cm ²	<0.05 ug
6CJ	John's House	Painted Drywall	Laboratory A	100 cm ²	<0.05 ug
7CJ	John's House	Wood	Laboratory A	100 cm ²	<0.05 ug
8CJ	John's House	Wood	Laboratory A	100 cm ²	<0.05 ug
9CJ	John's House	Tile	Laboratory A	100 cm ²	<0.05 ug
10CJ	John's House	Tile	Laboratory A	100 cm ²	<0.05 ug
11CJ	John's House	Blank	Laboratory A	100 cm ²	<0.05 ug
12CJ	John's House	Blank	Laboratory A	100 cm ²	<0.05 ug
1N	National Jewish	Glass	Laboratory A	100 cm ²	<0.05 ug
2N	National Jewish	Glass	Laboratory A	100 cm ²	<0.05 ug
3N	National Jewish	Refrigerator Door	Laboratory A	100 cm ²	<0.05 ug
4N	National Jewish	Refrigerator Door	Laboratory A	100 cm ²	<0.05 ug
5N	National Jewish	Painted Drywall	Laboratory A	100 cm ²	<0.05 ug
6N	National Jewish	Painted Drywall	Laboratory A	100 cm ²	<0.05 ug
7N	National Jewish	Wood	Laboratory A	100 cm ²	<0.05 ug
8N	National Jewish	Wood	Laboratory A	100 cm ²	<0.05 ug
9N	National Jewish	Tile	Laboratory A	100 cm ²	<0.05 ug
10N	National Jewish	Tile	Laboratory A	100 cm ²	<0.05 ug
11N	National Jewish	Blank	Laboratory A	100 cm ²	<0.05 ug
12N	National Jewish	Blank	Laboratory A	100 cm ²	<0.05 ug
MV1	Mikes House	Glass	Laboratory A	100 cm ²	<0.05 ug
MV2	Mikes House	Glass	Laboratory A	100 cm ²	<0.05 ug
MV3	Mikes House	Refrigerator Door	Laboratory A	100 cm ²	<0.05 ug
MV4	Mikes House	Refrigerator Door	Laboratory A	100 cm ²	<0.05 ug
MV5	Mikes House	Painted Drywall	Laboratory A	100 cm ²	<0.05 ug

MV6	Mikes House	Painted Drywall	Laboratory A	100 cm ²	<0.05 ug
MV7	Mikes House	Wood	Laboratory A	100 cm ²	<0.05 ug
MV8	Mikes House	Wood	Laboratory A	100 cm ²	<0.05 ug
MV9	Mikes House	Tile	Laboratory A	100 cm ²	<0.05 ug
MV10	Mikes House	Tile	Laboratory A	100 cm ²	<0.05 ug
MV11	Mikes House	Blank	Laboratory A	100 cm ²	<0.05 ug
MV12	Mikes House	Blank	Laboratory A	100 cm ²	<0.05 ug